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Docket No.: 49959-125

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Ron NAFTALI, et al.

Serial No.: 09/726,597

Filed: December 01, 2000

: **RESPONSE UNDER 37 CFR 1.116**

: **EXPEDITED PROCEDURE**

: Customer Number: 20277

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: Examiner: Vikkram Bali

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For: **HARDWARE CONFIGURATION FOR PARALLEL DATA PROCESSING WITHOUT  
CROSS COMMUNICATION**

**AMENDMENT UNDER 37 CFR 1.116**

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Commissioner for Patents  
P.O. Box 1450  
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**Technology Center 2600**

Sir:

The following Amendment and Remarks are submitted in response to the Final Office

Action mailed May 28, 2004. Please amend the above-identified application as follows.

07/30/2004 CNGUYEN 00000003 500417 09726597

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1. (Currently Amended) A method for inspecting a surface of an article, the method comprising:

scanning a predetermined section of said surface to collect data;

arranging the data as a two-dimensional array of data elements;

dividing the data into a plurality of columns;

dividing each data column into a plurality of data blocks;

providing a plurality of processing nodes for each data column, each processing node corresponding to one of the data blocks; and

processing the data blocks substantially simultaneously using the corresponding processing nodes, wherein each processing node performs the processing independently of the other processing nodes.

2. (Original) The method of claim 1, wherein the processing step comprises:

comparing data representative of an inspected pattern in the predetermined section of the surface with data representative of a corresponding pattern in another section of the surface; and

determining a suspected defect location exists when a significant difference exists between data of the inspected pattern and the corresponding pattern.

3. (Original) The method of claim 1, wherein the two-dimensional array is arranged as a plurality of lines of the data elements; and

wherein the data blocks each comprise an approximately equal number of lines.

4. (Original) The method of claim 1, wherein the two-dimensional array is arranged as a plurality of lines of the data elements, and wherein the processing nodes are provided as an

array comprising “n” nodes in the x direction and “m” nodes in the y direction; the method comprising:

dividing the data into the columns such that each line of each column comprises  $1/n$  of the number of data elements of each line; and

dividing the columns into the data blocks such that each of the data blocks comprises approximately  $1/m$  of the plurality of lines.

5. (Currently Amended) A method for inspecting a surface of an article, the method comprising:

scanning a predetermined section of said surface to collect data;

arranging the data as a two-dimensional array of data elements;

dividing the data into columns;

dividing each data column into a plurality of data blocks;

providing a plurality of processing nodes, each processing node corresponding to one of the data blocks; and

processing the data blocks substantially simultaneously using the corresponding processing nodes, wherein each processing node performs the processing independently of the other processing nodes;

wherein the two-dimensional array is arranged as a plurality of lines of the data elements, and wherein the processing nodes are provided as an array comprising “n” nodes in the x direction and “m” nodes in the y direction; the method further comprising:

dividing the data into the columns such that each line of each column comprises  $1/n$  of the number of data elements of each line; and

dividing the columns into the data blocks such that each of the data blocks comprises approximately 1/m of the plurality of lines;

~~The method of claim 4~~, wherein each processing node processes its corresponding data block as a plurality of data sub-blocks substantially simultaneously, each sub-block comprising a maximum number “max\_size” of lines, each node having an identification number, and wherein the step of dividing the columns into the data blocks comprises, for each processing node:

calculating a nominal number of lines to be processed by each node and an excess “mismatch\_1” number of lines based on the plurality of lines and the number of nodes m per column;

calculating a number of sub-blocks to be processed per node based on max\_size and the nominal number of lines per node;

calculating a nominal size, in lines, of the sub-blocks and an excess “mismatch\_2” number of lines based on the nominal number of lines per node and the number of sub-blocks per node;

increasing the size of a mismatch\_2 number of sub-blocks by one line; and

increasing the size of the node by one line based on mismatch\_1 and the node identification number.

6. (Currently Amended) A method for inspecting a surface of an article, the method comprising:

scanning a predetermined section of said surface to collect data;

arranging the data as a two-dimensional array of data elements;

dividing the data into columns;

dividing each data column into a plurality of data blocks;

providing a plurality of processing nodes, each processing node corresponding to one of the data blocks; and

processing the data blocks substantially simultaneously using the corresponding processing nodes, wherein each processing node performs the processing independently of the other processing nodes;

wherein the two-dimensional array is arranged as a plurality of lines of the data elements, and wherein the processing nodes are provided as an array comprising “n” nodes in the x direction and “m” nodes in the y direction; the method further comprising:

dividing the data into the columns such that each line of each column comprises  $1/n$  of the number of data elements of each line; and

dividing the columns into the data blocks such that each of the data blocks comprises approximately  $1/m$  of the plurality of lines;

~~The method of claim 4,~~ wherein each processing node processes one of the data blocks as a plurality of data sub-blocks substantially simultaneously, each sub-block comprising a maximum “max\_size” number of lines, each node having an identification number, and wherein the step of dividing the columns into the data blocks comprises, for each processing node:

calculating a nominal number of lines to be processed by each node and an excess “mismatch\_1” number of lines based on the plurality of lines and the number of nodes  $m$  per column;

calculating a number of sub-blocks to be processed per node based on max\_size and the nominal number of lines per node;

calculating a nominal size, in lines, of the sub-blocks and an excess “mismatch\_2” number of lines based on the nominal number of lines per node and the number of sub-blocks per node;

determining a variable “threshold”, wherein threshold is equal to mismatch\_2 when the node identification number is greater than or equal to mismatch\_1, and threshold is equal to mismatch\_2 + 1 when the node identification number is less than mismatch\_1; and

increasing the size of a threshold number of sub-blocks by one line.

7. (Original) The method of claim 1, wherein the processing step comprises:

comparing data representative of an inspected pattern in the predetermined section of the surface with data representative of a corresponding reference pattern ; and

determining a suspected defect location exists when a significant difference exists between data of the inspected pattern and the reference pattern.

8. (Original) The method of claim 4, comprising scanning with m number of sensors, and arranging the data such that all the data collected by one of the sensors is in one of the columns.

9. (Original) An apparatus for parallel processing of a data stream, comprising:

a data formatter for receiving a data stream and constructing therefrom a plurality of data lines, said data formatter comprising n output lines, each outputting respective 1/n of each of the data lines; and

n processing groups, each comprising m processing nodes commonly connected to one of the n lines,

wherein each of the  $m$  processing nodes is for processing approximately  $1/m$  of the data flowing in one of the  $n$  lines substantially simultaneously and independently of the other processing nodes.

10. (Original) The apparatus of claim 9, wherein each processing node is for processing the approximately  $1/m$  of the data as a plurality of data sub-blocks substantially simultaneously, each sub-block comprising a maximum number “max\_size” of lines, and each node has an identification number and a processor configured to perform the steps of:

calculating a nominal number of lines to be processed by each node and an excess “mismatch\_1” number of lines based on the plurality of data lines and the number of nodes  $m$  per processing group;

calculating a number of sub-blocks to be processed per node based on max\_size and the nominal number of lines per node;

calculating a nominal size, in lines, of the sub-blocks and an excess “mismatch\_2” number of lines based on the nominal number of lines per node and the number of sub-blocks per node;

increasing the size of a mismatch\_2 number of sub-blocks by one line; and

increasing the size of the node by one line based on mismatch\_1 and the node identification number.

11. (Original) The apparatus of claim 9, wherein each processing node is for processing the approximately  $1/m$  of the data as a plurality of data sub-blocks substantially

simultaneously, each sub-block comprising a maximum number “max\_size” of lines, and each node has an identification number and a processor configured to perform the steps of:

calculating a nominal number of lines to be processed by each node and an excess “mismatch\_1” number of lines based on the plurality of data lines and the number of nodes m per processing group;

calculating a number of sub-blocks to be processed per node based on max\_size and the nominal number of lines per node;

calculating a nominal size, in lines, of the sub-blocks and an excess “mismatch\_2” number of lines based on the nominal number of lines per node and the number of sub-blocks per node;

determining a variable “threshold”, wherein threshold is equal to mismatch\_2 when the node identification number is greater than or equal to mismatch\_1, and threshold is equal to mismatch\_2 + 1 when the node identification number is less than mismatch\_1; and

increasing the size of a threshold number of sub-blocks by one line.

12. (Currently Amended) A substrate inspection apparatus, comprising:

a light source illuminating the wafer;

a plurality of light sensors providing image data of areas of the substrate illuminated by the light source;

a data formatter for receiving said data and constructing therefrom a plurality of data lines, said data formatter comprising n output lines, each outputting respective 1/n of each of the data lines;

n processing groups, each comprising m processing nodes commonly connected to one of the n lines,



wherein each of the  $m$  processing nodes is for processing approximately  $1/m$  of the data flowing in one of the  $n$  lines substantially simultaneously and independently of the other processing nodes.

13. (Original) The inspection system of claim 12, wherein said plurality of light sensors comprises at least two dark field sensors.

14. (Original) The inspection system of claim 13, wherein said plurality of light sensors further comprise a bright field sensor.

15. (Original) The inspection system of claim 12, wherein the plurality of light sensors comprises a TDI detector.

16. (Original) The inspection system of claim 12, wherein said data formatter comprises a multiplexer.